



Ariel Dynamics Inc. Media Library - Video

Coto Research Center



Code	adi-vid-01027
Title	Coto Research Center
Subtitle	A Unique Sports Research Center
Description	Biomechanics: "bio" means life, "mechanics" is the science of motions and stresses...
Subject	APAS;Biomechanics;Favorite;Performance Analysis;Science;Sports
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Privacy	Public

Coto de Caza Sports Research Center

Coto de Caza, a coastal valley in California, is home to a unique sports research center led by psychologist Rick Brayton and computer biomechanics pioneer, Dr. Gideon Ariel. The center focuses on the study of biomechanics, the science of motions as related to biological systems.

Biomechanics in Athletics

In athletics, the distance a shot, discus, or high jump goes depends on the forces produced to move the object. These forces, while invisible, can be calculated using biomechanics. The center uses high-speed photography and a digitizer to trace the joint center of an athlete, which is then processed by a computer.

Data Processing and Analysis

The computer processes the X and Y coordinates from the digitizers and stores it in memory. After digitizing, which can take up to an hour and a half for about a hundred frames, the pictures can be reconstructed on the screen. The computer then provides data on displacement, velocities, and acceleration.

Application of Biomechanics

Understanding the pattern of movement or acceleration in each sequence is crucial for understanding proper movement. After interpreting the results, changes might be made and the athlete retested. This technique is non-invasive and can be used during actual competitions.

Direct Force Measurement

The center also uses a direct method of force measurement, which records the forces directly and provides data on three octagonal forces. This method is particularly useful for runners, as it can measure the shock transferred to the body and help in designing better shoes for athletes.

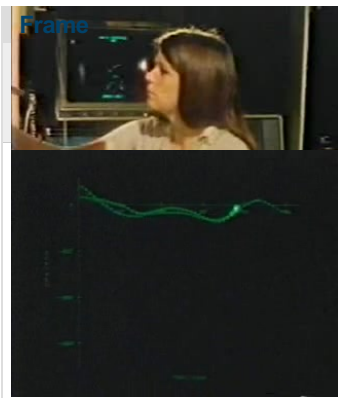
Accuracy of Results

The results of these calculations are as factual as gravitational laws. The center's system, utilizing the mega deck graphic system, the data general computer, and the talus digitizing system, allows for continuous analysis and improvement of an athlete's performance.

Model Id: gpt-4-0613
Created on: 2023-09-19 00:23:32
Processing time: 00:00:24.8950000

Audio transcription

Frame	#	Time	Spoken text
	0.	00:00:00	<i>Coto de Caza, a coastal valley in ours drive south of Los Angeles, California, is the home</i>
	1.	00:00:08	<i>of a unique sports research center, which is headed by psychologist Rick Brayton and</i>
	2.	00:00:14	<i>computer biomechanics pioneer, Dr. Gideon Ariel.</i>
	3.	00:00:18	<i>Dr. Ariel, what is biomechanics?</i>
	4.	00:00:22	<i>Well, literary, basically it's what the world say.</i>
	5.	00:00:26	<i>Biomeans life, mechanics mean the science of motions, the science of stresses.</i>
	6.	00:00:33	<i>So what we try to do is actually we're combining life with the physical laws that affect in</i>
	7.	00:00:40	<i>life and that's where the world comes biomechanics, the science of motions as related</i>
	8.	00:00:46	<i>to biological system.</i>
	9.	00:00:49	<i>Whatever happened in athletics, how far the shot go, how far the discus go, how far the</i>
	10.	00:00:54	<i>high jump go, it all depends on how much forces were produced to be able the object to</i>
	11.	00:01:01	<i>and the object could be the human body, or could be a shot, could be a javelin, could</i>
	12.	00:01:05	<i>be a discus, could be a hammer, could be a frisbee.</i>
	13.	00:01:08	<i>We cannot see the forces, but we can calculate the forces.</i>
	14.	00:01:12	<i>When we're talking about biomechanics, we're talking about calculations of kinetic</i>
			<i>parameters</i>
	15.	00:01:18	<i>or the forces that are acting upon the body.</i>
	16.	00:01:22	<i>We're utilizing a high-speed firm using photography.</i>
	17.	00:01:29	<i>Now after we develop the firm, we can utilize an instrument which is called a digitizer.</i>
	18.	00:01:35	<i>You actually see the picture projected on the digitizer.</i>
	19.	00:01:39	<i>What we are doing, we're using a sonic pan to trace the joint center of the athlete and</i>
	20.	00:01:46	<i>these joint center locations going right to the computer.</i>
	21.	00:01:50	<i>Now at the past, people did it by hand, it took months and months to do one analysis.</i>
	22.	00:01:56	<i>What the computer does, it takes the X and Y coordinates from the digitizers and put</i>
	23.	00:02:02	<i>it into a memory.</i>
	24.	00:02:04	<i>After we did a digitizing process which takes some time hour, hour and a half to trace</i>
			<i>about</i>
	25.	00:02:10	<i>hundred frames each frame separately, we can reconstruct the pictures on the screen</i>
26.	00:02:17	<i>or the megategraphic system.</i>	
27.	00:02:22	<i>The data is processed by the computer and it gives us the following thing, the</i>	
28.	00:02:27	<i>displacement,</i>	
			<i>how much the joint center moves, from that we can derive the velocities or how fast or</i>



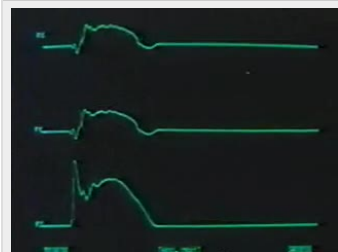
#	Time	Spoken text
29.	00:02:33	<i>the speed of the segments, from that we can derive the acceleration and acceleration is</i>
30.	00:02:38	<i>very important because the second Newton law said that force equaled to mass times acceleration.</i>
31.	00:02:49	<i>If we know the mass of the different body parts and if we know the acceleration from this</i>
32.	00:02:54	<i>technique, we can calculate the forces and what make an athlete move is actually rely</i>
33.	00:02:59	<i>on forces.</i>
34.	00:03:00	<i>The pattern of the movement or the acceleration pattern in each sequence is critically understanding</i>



35.	00:03:07	<i>of the proper movement.</i>
36.	00:03:15	<i>After we interpret the results of the athlete, we might make some changes and then two weeks</i>
37.	00:03:21	<i>later we retest him again and see if he correct this technique.</i>
38.	00:03:29	<i>This is the non-direct measurement.</i>
39.	00:03:32	<i>The uniqueness in this technique is that it's non-invasive.</i>



40.	00:03:36	<i>We don't touch the athlete while we're taking the film, that's why the athlete can perform</i>
41.	00:03:40	<i>in the Olympic Games or in our Cotto Sport Research Center and he even doesn't know when</i>
42.	00:03:46	<i>we're taking the film and then we analyze it.</i>
43.	00:03:59	<i>The direct method consists of a force measurement device that records the forces directly.</i>
44.	00:04:04	<i>It gives us the three octagonal forces.</i>



45.	00:04:06	<i>This is a direct measurement, it's very important for example for a runner.</i>
46.	00:04:10	<i>How much shock it transferring to his body?</i>
47.	00:04:13	<i>For example, comparison between shoes can reveal to us immediately the data if there</i>
48.	00:04:18	<i>is any difference in force transmission to the body.</i>
49.	00:04:22	<i>Also how can we construct better shoes or how can we design shoes for particular athlete</i>






50.	00:04:27	<i>so you can perform in the Olympic Games better?</i>
51.	00:04:31	<i>Dr. Ariel, how factual are the results of your calculations?</i>
52.	00:04:36	<i>Well it's as factual as gravitational laws.</i>
53.	00:04:41	<i>It's like when somebody said that I left the shot put and it fell down.</i>
54.	00:04:46	<i>Very seldom am I here, somebody said I left the shot put and fell up.</i>



55.	00:04:50	<i>It's a physical loss, it cannot fall up unless you are in the moon.</i>
56.	00:04:55	<i>So if we find out that there is some kind of linkage here that translates momentum</i>
57.	00:05:01	<i>from one segment to the other, it couldn't be, it will be any different.</i>
58.	00:05:05	<i>Also I used to tell the shot put the shot put the shot put the shot put the shot put the</i>
59.	00:05:07	<i>psychology and I said well, I don't know yet the shot put the shot through the shot,</i>

60.	00:05:12	<i>the shot just left the hand and then it concentrate and the sun is zoomed when five feet farther.</i>
61.	00:05:18	<i>I never saw that.</i>
62.	00:05:19	<i>If it ever happened, it always happened when it was still in contact with the fingers</i>

Frame	#	Time	Spoken text
	63.	00:05:24	<i>and when the forces were transmitted through the dynamic link into the shot from the hand.</i>
	64.	00:05:29	<i>All this concentration and all this shouting and all this jumping after the shot left the hand,</i>
	65.	00:05:34	<i>this is a this is just in person on the audience.</i>
	66.	00:05:37	<i>The the shot is going to land where it's supposed to land.</i>
	67.	00:05:45	<i>So in order to summarize the whole system, utilizing the mega deck graphic system,</i>
	68.	00:05:50	<i>the data general computer, the talus digitizing system, we can bring</i>
	69.	00:05:55	<i>outlets to our core to sport research center, running analysis on them the first two days,</i>
	70.	00:06:00	<i>run for two more weeks of training, retest them, see the changes, recorrect them again</i>
	71.	00:06:06	<i>and later in two weeks again we follow up with another analysis and I am assure you we will have</i>
	72.	00:06:11	<i>August.</i>

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